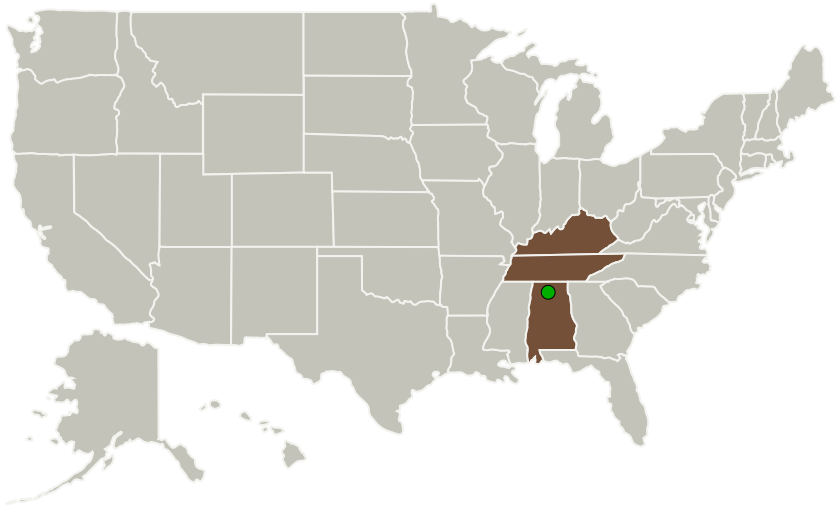
Torque Control of Friction Stir Welding, Phase I

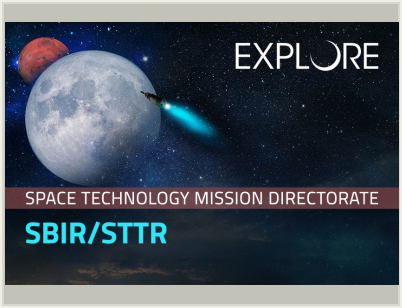
Completed Technology Project (2011 - 2012)

Project Introduction

Longhurst Engineering, PLC and Vanderbilt University propose the innovation of torque control of friction stir welding (FSW) as a replacement to force control of FSW. The value of the torque is significant because it indicates how far the tool is plunged into the work piece. Proper engagement of the tool into the work piece is critical for producing reliable welds. The commercialized innovation will consist of three elements. First, a FSW tool will be developed to produce a linear relationship between the welding torque and the tool's plunge depth into the work piece. Second, the welding torque will be measured from outside the welding environment via the spindle motor current, thus eliminating the need for expensive force sensors associated with force control. Third, a closed-loop architecture will be designed and implemented to control the welding torque. Torque control of FSW can be applied by NASA to increase welding reliability with the Upper Stage of the Ares I launch vehicle. Torque control will also reduce capital investment and operations costs for NASA. The expected TRL is 4 at the beginning of the project and 5 at the end of Phase I.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Longhurst Engineering, PLC	Lead Organization	Industry	Guthrie, Kentucky
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama
Vanderbilt University	Supporting Organization	Academia	Nashville, Tennessee

Primary U.S. Work Locations	
Alabama	Kentucky
Tennessee	

Project Transitions

February 2011: Project Start

February 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139505)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Longhurst Engineering, PLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

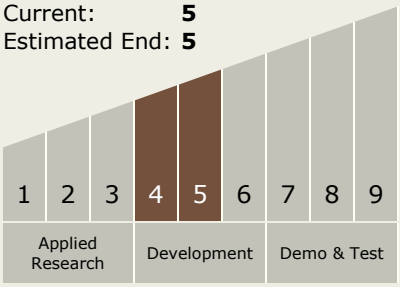
Carlos Torrez

Principal Investigator:

George E Cook

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.4 Advanced Propulsion
    - TX01.4.2 Electromagnetic Tethers

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System